

Effect of Ambipolar Potential on the Propulsive Performance of the GDM Plasma Thruster, Phase I

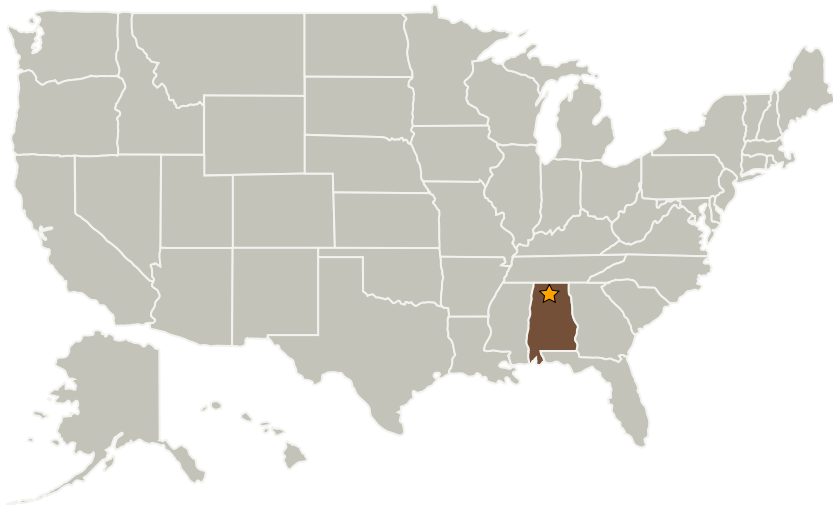
Completed Technology Project (2004 - 2005)



Project Introduction

The gasdynamic mirror (GDM) plasma thruster has the ability to confine high-density plasma for the length of time required to heat it to the temperatures corresponding to specific impulse requirements. The often-cited plasma confinement time is directly proportional to the mirror ratio and the length, and is inversely proportional to the square root of ion energy. This confinement law, however, ignores the role of the ambipolar (electrostatic) potential which arises as a result of the rapid escape of electrons through the mirrors due to their small mass. This positive potential tends to accelerate the ions while slowing down the electrons until both species drift out at the same rate. It is expected, therefore, that a larger specific impulse and larger thrust will arise in the presence of ambipolar potential but at the expense of a longer device to maintain a desired confinement time. This proposal is aimed at a theoretical and computational investigation of the impact of the ambipolar potential on the propulsive capability of the GDM thruster. It includes the generation of parameters that will allow experimental verification of this phenomenon using the existing GDM device at the Marshall Space Flight Center (MSFC).

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Reisz Engineers	Supporting Organization	Industry	Huntsville, Alabama

Primary U.S. Work Locations

Alabama

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.2 Electric Space Propulsion
 - └ TX01.2.3 Electromagnetic